

TITLE

Development of EUV / DUV Source for Semiconductor Manufacturing and its Application

AUTHOR

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ABSTRACT

In this conference, we will report about new EUV research activities in Kyushu-Univ. in Japan.

1st topic is new EUV exposure research center: named "EUV Photon Co.. This organization will support material development of material industry of EUV lithography, for example photo-resist, and photo mask and so on. We prepare EUV light source and exposure optical system and vacuum chamber system for this exposure. In this presentation we will report latest preparation of this organization.

2nd topic is new high power EUV source research program which has been preparing in Kyushu-University. Since 2003 we corroborate EUV source research with Gigaphoton. We are pioneer of combination of pulsed CO₂ laser and Sn droplets, dual wavelength pico second laser pulses for shooting and debris mitigation by magnetic field have been applied. We have demonstrated high average power >300W EUV power with CO₂ laser more than 27kW at output power in cooperation with Gigaphoton and Mitsubishi Electric up to now²⁾. Also we are thinking about the Sn plasma dynamics which dominate the EUV emission by using Thomson Scattering (TS) measurement. Last year our group announced possibility of 10% conversion efficiency with simulation and experiment (fig.3)³⁾. These results mention that there is still sufficient potential to increase EUV output power and conversion efficiency in near future

At the conference, we will report latest update of above two topics.

Reference

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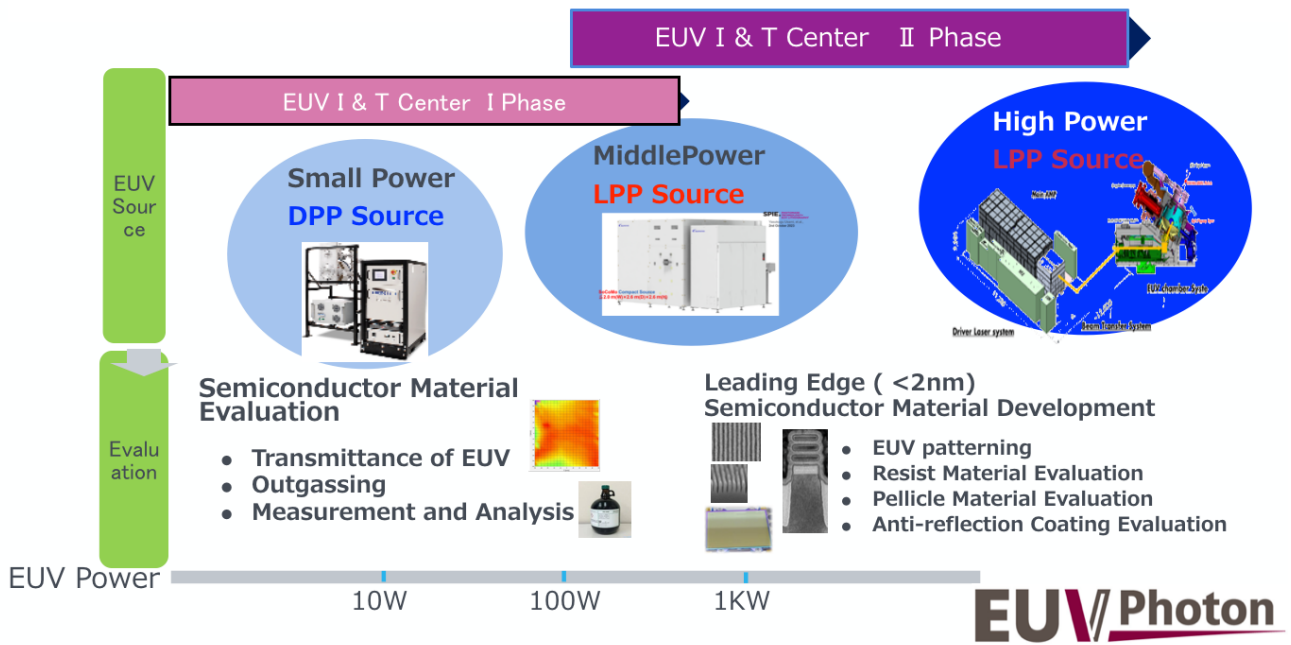


Fig.1 Exposure Road Map of “EUV Photon”

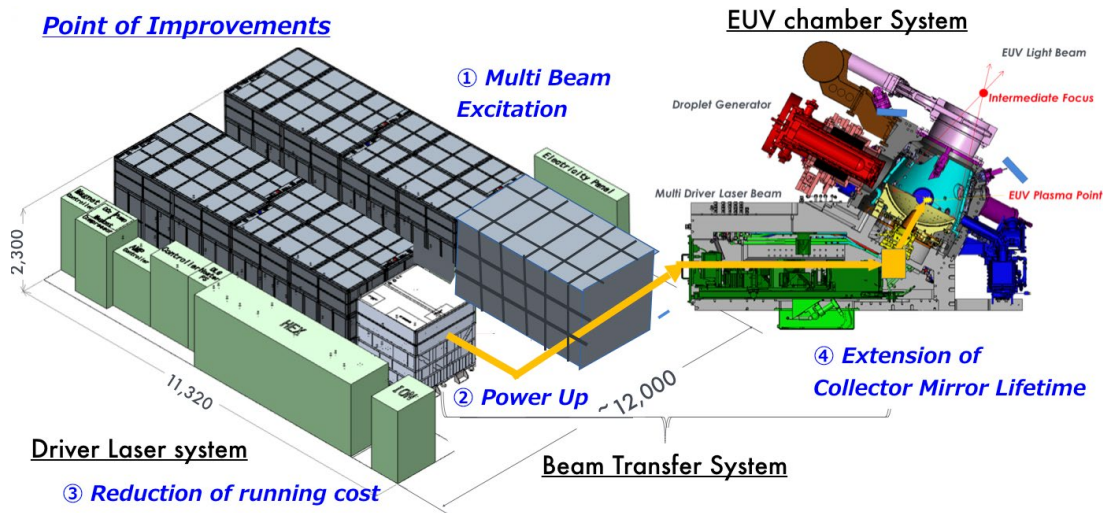


Fig.2 Higer power EUV Source Investigation in Kyushu Univ.



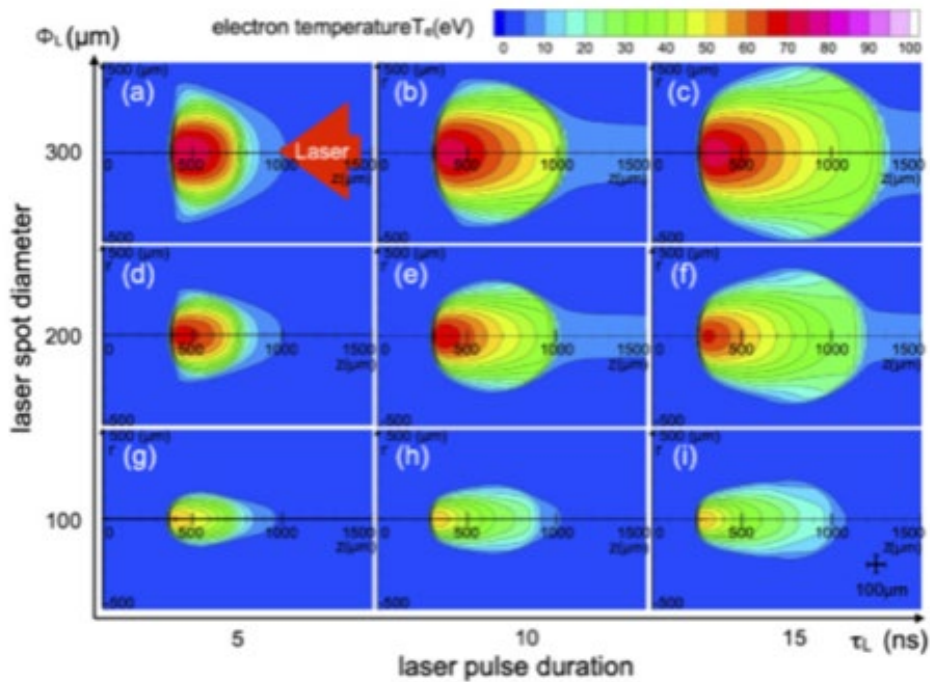


Fig.3 EUV Plasma simulation predict >10% conversion efficiency ³⁾

Biographies



Hakaru Mizoguchi

Title/ Position: Guest Professor of Kyushu University. (He was Senior Fellow of Gigaphoton Inc.) He is Fellow of The International Society of Optical Engineering (SPIE), and member of The Laser Society of Japan and The Japan Society of Applied Physics. He received a diplomat degree in plasma diagnostics field from the Kyushu university, Fukuoka, Japan in 1982 and join Komatsu ltd.. He joined CO2 laser development program in Komatsu for 6 years. After that he was guest scientist of Max-Plank Institute Bio-Physikalish-Chemie in Goettingen in Germany 2 years, from 1988 to 1990. Since 1990 he concentrated on KrF, ArF excimer laser and F2 laser research and development for lithography application. He was general manager of research division in Komatsu Ltd. until 1999. He got Dr. degree in high power excimer laser field from Kyushu university in 1994. In 2000 Gigaphoton Inc. was founded. He was one of the founders of Gigaphoton Inc.. From 2002 to 2010 he organized EUV research group in EUVA program. Now he is promoting EUV light source development with present position. He got Sakurai award from OITDA Japan in 2018, and IAAM Scientist Award in Advanced Materials Lecture Series 2020.



Kentaro Tomita

Title/ Position: Associate Professor of Hokkaido University

He received B. S., M. S., and Ph. D. degrees from Kyushu University, Japan, in 2002, 2004, and 2014, respectively. In November 2006 he was appointed Research associate at Kyushu University and became Assistant Professor in April 2007 at the same university. He became Associate professor in July 2020 at Hokkaido University, Japan. He is engaged in research of laser-aided diagnostics of industrial plasmas such as laser produced plasma for extreme ultra-violet light sources, atmospheric-pressure non-equilibrium plasma, arc discharge plasma, etc., which are produced under high pressure.



Prof. Masaharu Shiratani

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